



U.S. DEPARTMENT OF  
**ENERGY**

OFFICE OF  
**ENVIRONMENTAL  
MANAGEMENT**

# SRS L-Basin Spent Nuclear Fuel Program Update

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**Maxcine Maxted**

*Spent Nuclear Fuel Program Manager*  
Savannah River Site

**Presented to the Nuclear Materials Committee**  
**August 9, 2016**

Nuclear Materials Committee requested a 2016 Work Plan topic on L Area:

- Provide an update on L Area Operations
  - ❑ Status of L-Basin Capacity
  - ❑ Status of Shipments to H-Canyon
- Transportation of SNF



Spent Nuclear Fuel Storage

# Acronyms

Al –clad – Aluminum clad

AROD – Amended Record of Decision

CFR – Code of Federal Regulations

CNLL – Canada Nuclear Laboratories Limited

DRR – Domestic Research Reactor

DSA – Documented Safety Analysis

FY – Fiscal Year

FRR- Foreign Research Reactor

HEU – Highly Enriched Uranium

HFIR – High Flux Isotope Reactor

IAEA – International Atomic Energy Agency

ISO – International Standards Organization

lbf/in<sup>2</sup> –pound foot/square inch (pressure measurement)

LWT – Legal Weight Truck

MTR – Material Test Reactor

NRU – National Research Universal

NRX – National Research Experimental

NNSA – National Nuclear Security Administration

PBS 11C- Performance Baseline Summary for  
Nuclear Material Stabilization and  
Disposition

PBS 12 – Performance Baseline Summary for SNF  
Stabilization and Disposition

SNF – Spent Nuclear Fuel

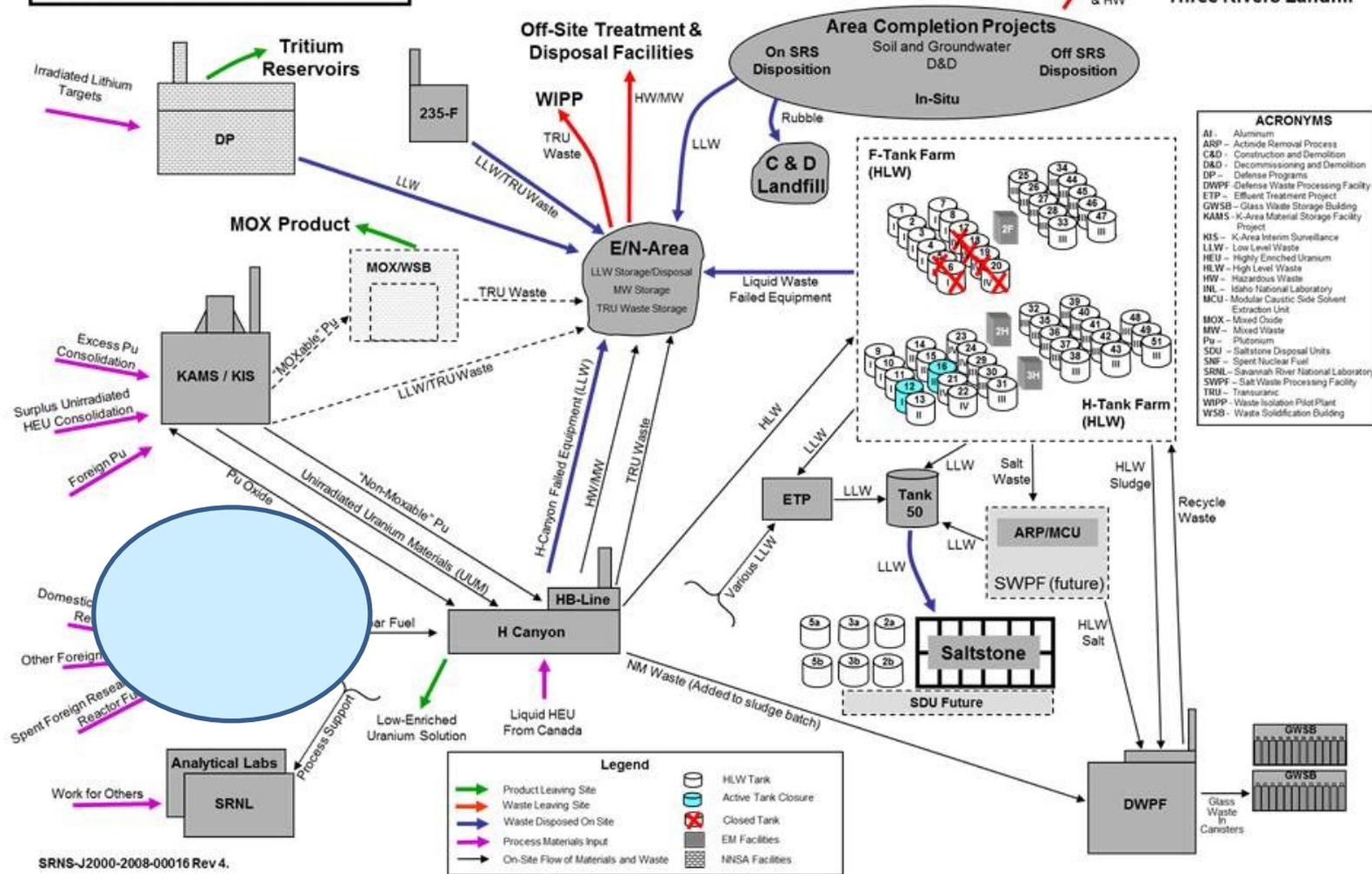
SRE – Sodium Reactor Experiment

STS – Shielded Transfer System

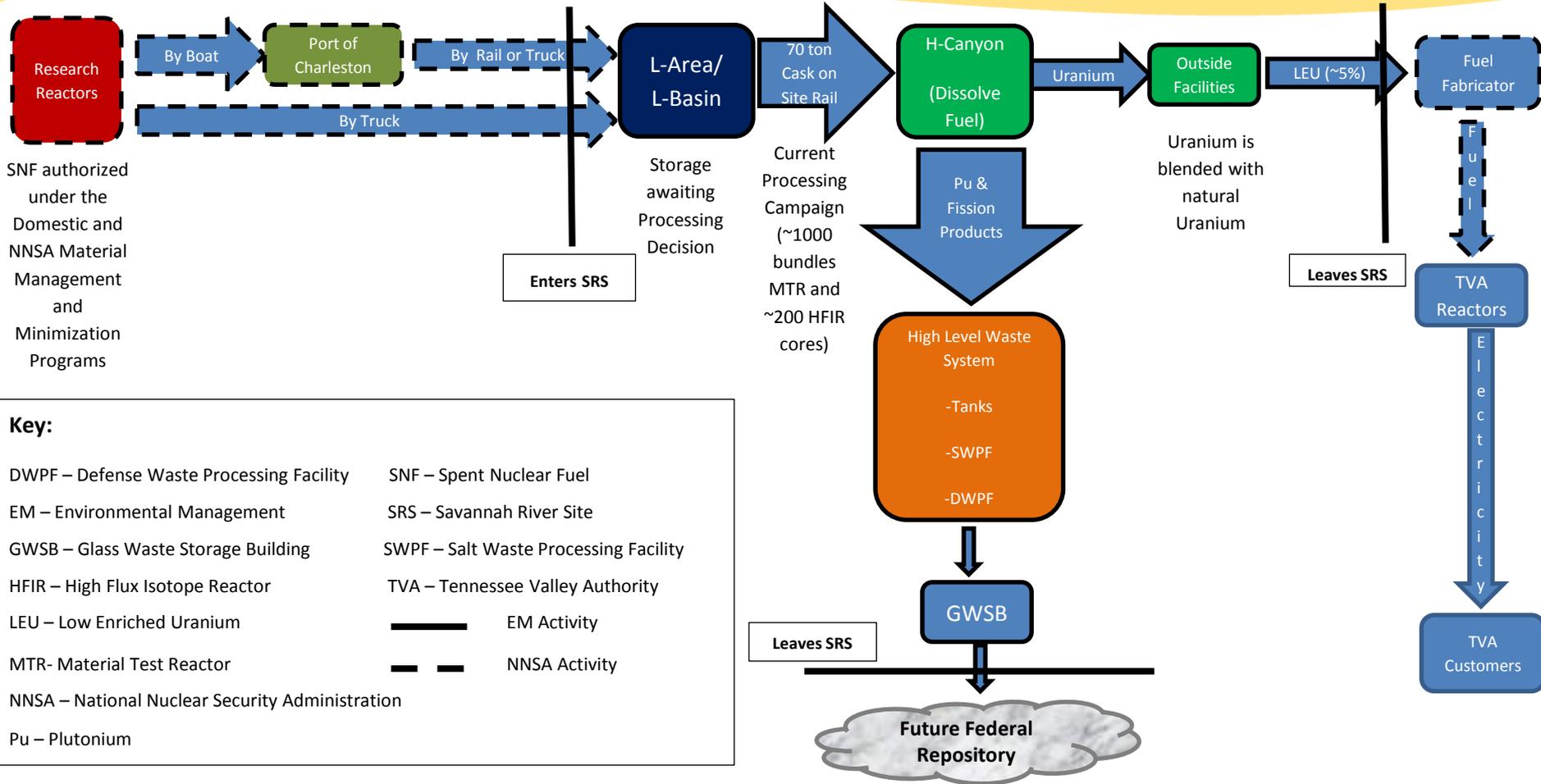
# Savannah River Site Waste and Material Flow Path

This depiction of SRS activities shows only the general scope of the major facilities and missions. It does not represent all processes or all materials flow.

Off-Site Disposal  
e.g., Clive, Utah,  
Three Rivers Landfill



# SRS Spent Nuclear Fuel Flow Path

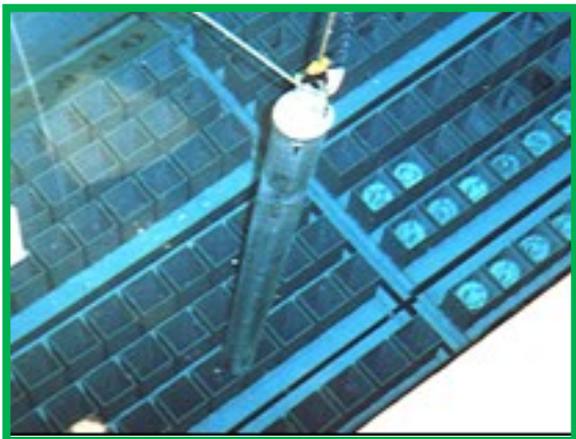


**Key:**

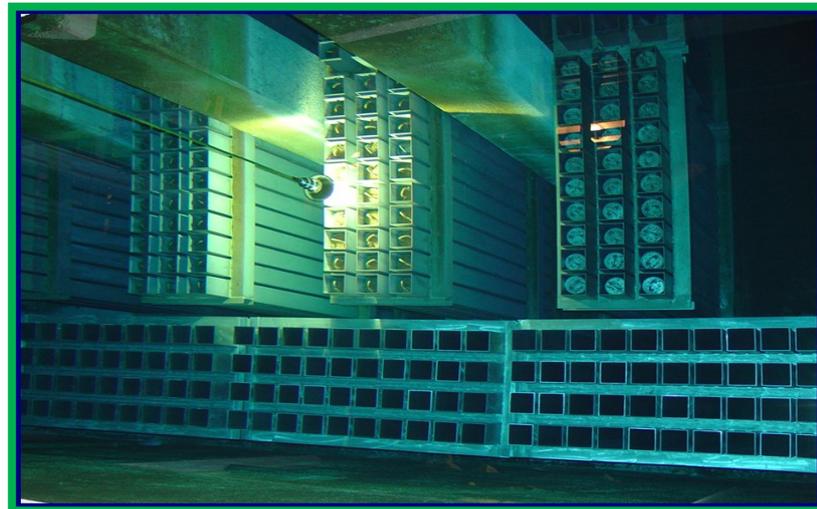
DWPF – Defense Waste Processing Facility	SNF – Spent Nuclear Fuel
EM – Environmental Management	SRS – Savannah River Site
GWSB – Glass Waste Storage Building	SWPF – Salt Waste Processing Facility
HFIR – High Flux Isotope Reactor	TVA – Tennessee Valley Authority
LEU – Low Enriched Uranium	— EM Activity
MTR- Material Test Reactor	- - NNSA Activity
NNSA – National Nuclear Security Administration	
Pu – Plutonium	

# Overview of L-Basin

- L-Basin capacity was expanded from the original reactor basin in the 1990s
  - ~3.4 Million gallons of water
  - Pool Depth 17 to 50 feet
  - Receives typical Foreign Research Reactor (FRR) / Domestic Research Reactor (DRR) Material Test Reactor Fuel Assemblies
  - One transfer bay for receipts/shipments



Suspended Fuel Bundle



- Spent Nuclear Fuel is Safely and Securely Stored in Reinforced Concrete Facility, Underwater Basin (L-Area)
- Continuous Surveillance and Maintenance is projected to achieve at least 50 additional years of safe storage

# L-Basin Stored Fuels and Capacities

- L-Bundled fuel

- Typical FRR/DRR Material Test Reactor Fuel Assemblies
- Capacity = 3650 bundles
- Current inventory = ~3020 bundles
- Amended Record of Decision (AROD) processing decision eliminates need for new racks



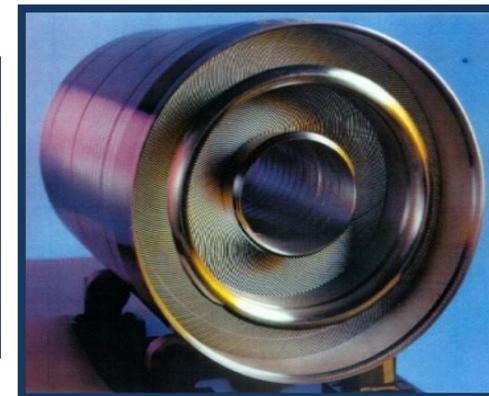
70 Ton Cask and railcar

- High Flux Isotope Reactor (HFIR) Fuel Racks

- 100% full
- 120 Cores
- AROD processing decision eliminates need for new racks; expected to start by 9/30/2017



Isolation Can

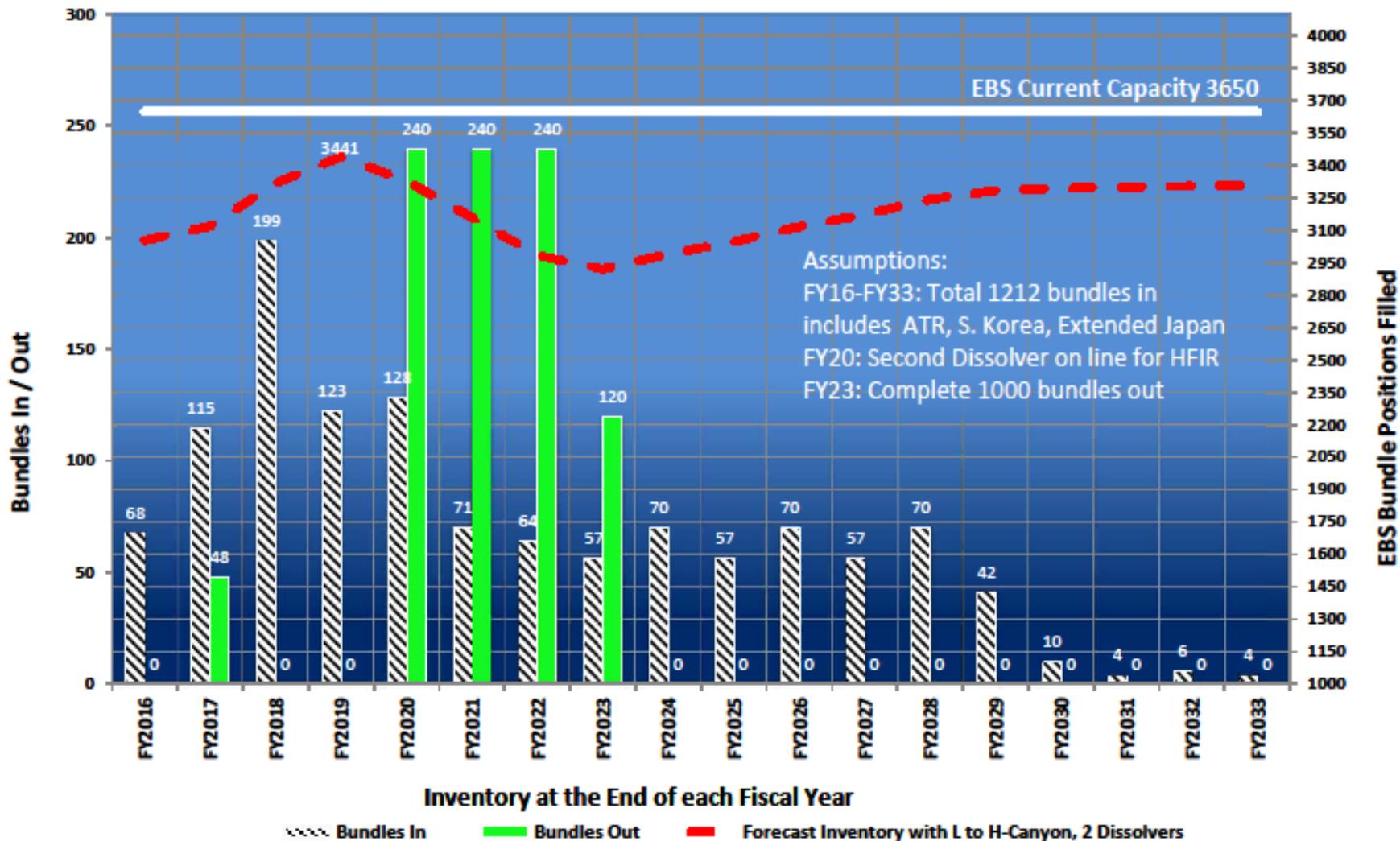


HFIR Fuel

- Isolation Cans

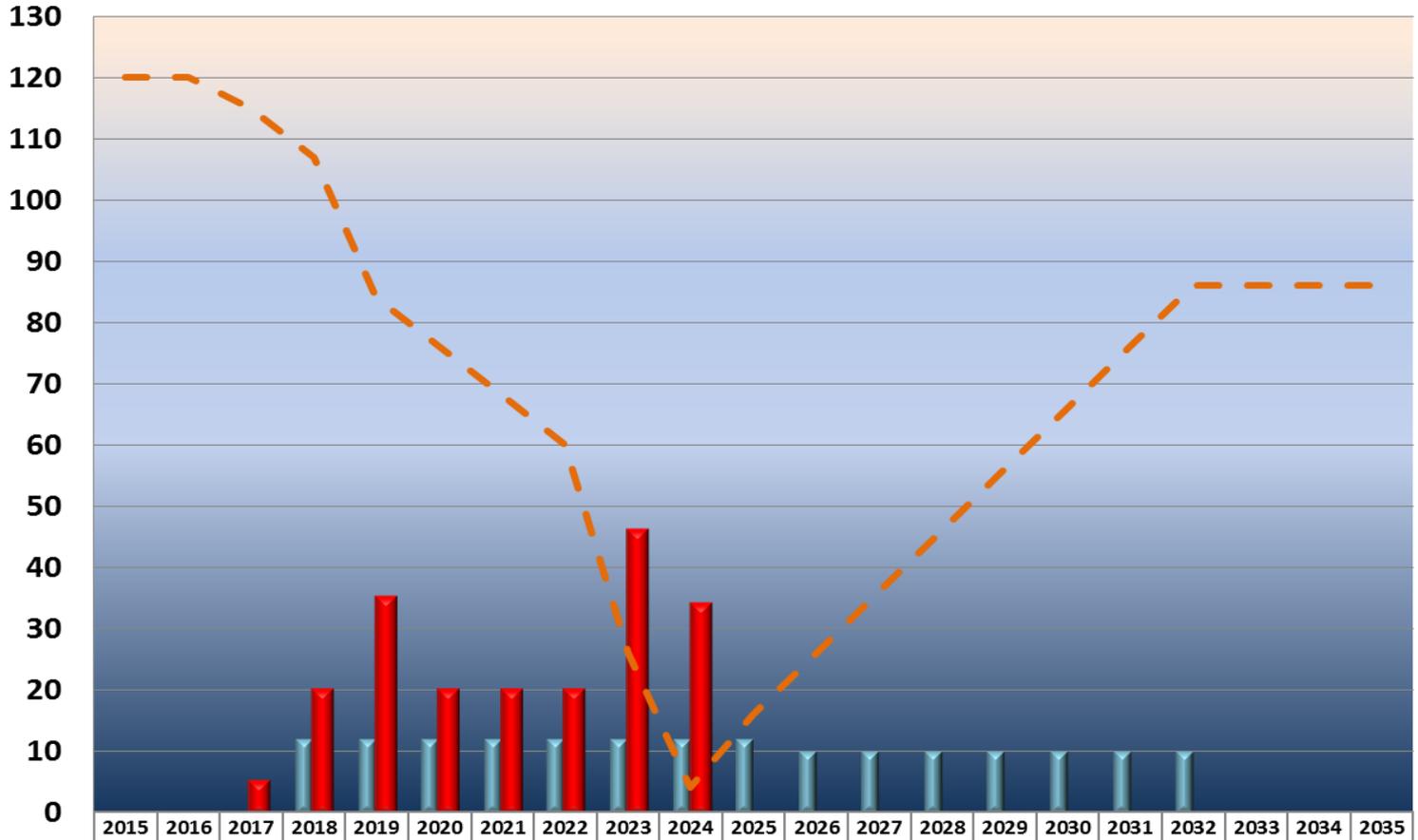
- Over 400 individual isolation cans stored in 12 oversized cans

# Forecast EBS Bundle Positions Filled by FRR/DRR Receipts with H-Canyon Processing



# L-Basin HFIR Storage Capacity, Receipts, Canyon Processing

HFIR Cores



HFIR Received L Basin	0	0	0	12	12	12	12	12	12	12	12	10	10	10	10	10	10	10	0	0	0
HFIR Canyon Processing	0	0	5	20	35	20	20	20	46	34	0	0	0	0	0	0	0	0	0	0	0
HFIR Inventory L Basin	120	120	115	107	84	76	68	60	26	4	16	26	36	46	56	66	76	86	86	86	86

# Receipt Cask Handling in L-Basin



**Receive Cask/  
Removed Impact Limiters**



**Cask Placed Under Water**



**Lid Removed**



**Cask with fuel ready for verification**



**Fuel Removal & placed in bucket for  
transfer to Basin from Transfer Bay**



**Decon, Reassembly &  
Ship Empty Cask**

# L-Area Accomplishments in Fiscal Year 2016

- Received 6 FRR casks and 4 DRR casks in Fiscal Year 2016 as of July 30, 2016
- In FY15, pre-shipped SNF to H-Canyon for processing in FY16. Anticipating at least one shipment of SNF to H-Canyon before the end of FY16
- Continued safe storage of SNF and Heavy Water



International Standards Organization (ISO) Container containing a Legal Weight Truck (LWT) Cask



Shielded Transfer System (STS)

# Transportation of Spent Nuclear Fuel

- Governed by Department of Transportation (DOT) and Nuclear Regulatory Commission (NRC)
- SNF requires a Type B Cask certified to meet 10CFR71 requirements
- Regulations are put in place to ensure material remains contained even during hypothetical accident conditions.
- Type B Cask must pass the following test conditions for
  - Normal conditions of transport (10 CFR 71.71):
 

• Heat (100 °F plus insolation)	Cold (-40 °F)
• Increased External Pressure(20 lbf/in <sup>2</sup> )	Decreased External Pressure (3.5 lbf/in <sup>2</sup> )
• Vibration	Water Spray
• Free Drop	Compression
• Penetration	
  - Hypothetical accident conditions(10 CFR 71.73):
    - Free drop (a 30 foot drop onto a flat, unyielding surface so that the package's weakest point is struck)
    - Crush (a 1100 lb mass dropped from 30 ft onto package placed on unyielding horizontal surface)
    - Puncture (a 40 inch free drop onto a 6 inch diameter steel rod at least 8 inches long, striking the package at its most vulnerable spot)
    - Thermal (exposure of the entire package to a 1,475 °F fire for 30 minutes)
    - All tests are done to the same package in the above order
    - Immersion (Immersion of the package under 50 feet of water for at least 8 hours - allowed to use an new/untested package for this test.)

TRUPACT III testing

[https://www.youtube.com/watch?v=YCk\\_UZEjpnY](https://www.youtube.com/watch?v=YCk_UZEjpnY)

Train crash tests

<https://www.youtube.com/watch?v=U1nvRBk4W3o>

# Casks Handled in L-Basin

## F-257



7,000 lbs  
MAX CAPACITY = 1 SLOWPOKE Core

## JRF-90Y-950K



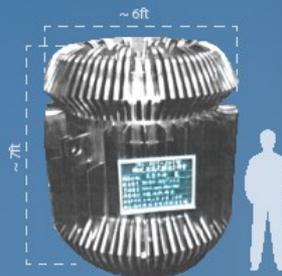
2,100 lbs  
MAX CAPACITY = 10 MTR

## 18.5T



41,000 lbs  
MAX CAPACITY = 30 MTR

## 20T



52,000 lbs  
MAX CAPACITY = 40 MTR

## TN-MTR



52,000 lbs  
MAX CAPACITY = 52 MTR

## GNS-16



34,000 lbs  
MAX CAPACITY = 33 MTR

## GE-2000



33,550 lbs  
MAX CAPACITY = HFIR, 1 inner, 1 outer

## BRR



32,000 lbs  
MAX CAPACITY = 8 MTR

## TN-7/2



54,400 lbs  
MAX CAPACITY = 64 MTR

## LWT



52,000 lbs  
MAX CAPACITY = 42 MTR

## Processing in H-Canyon

- Provides a method to recover the uranium for reuse and eliminates potential issues with stability of the fuel form after long term storage
- Amended Record of Decision (AROD) allows :
  - Processing up to 1000 bundles and 200 High Flux Isotope Cores
  - 120 bundles shipped to H-Canyon through July 2016
  - Amount shipped and processed is dependent on funding amounts received
- H-Canyon continued processing of the L-Basin Aluminum Cladded Fuel past the AROD amounts is possible but no decision has been made to pursue this at this time
- H-Canyon currently cannot process the Stainless and Zircaloy cladded fuels stored in L-Basin (~ 10% of the inventory by volume)

## Dry Storage

- Removes fuel from wet storage and places into a dried container awaiting a final repository
- Technical questions exist on how long to dry and how dry is dry for aluminum clad fuel need to be addressed

- Fuel is Safely Stored in L-Basin
- Transportation of SNF is being safely conducted around the US and is governed by DOT and NRC. Regulations are put in place to ensure material remains contained even during hypothetical accident conditions.
- Some processing of SNF is occurring in H-Canyon
- Departmental Decision needed on future direction of fuel storage versus processing